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JOURNAL OF ELECTRICITY
POWER AND GAS
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LOGGING BY ELECTRICITY[1]

BY E. J. BARRY.

In October of last year the Potlatch Lumber Company, of Elk River, Idaho, placed in service two electric logging engines, and from the results obtained it is confidently anticipated that these will prove the forerunners of many similar installations in all countries where logging operations are carried on. Recently the writer was able to make a test on these machines, and the results are given in the hope that they may be of interest to engineers in general.

The logging engines were especially designed and built for electric drive, for use with what is known as the McFarlane skyline system. The McFarlane system is especially adapted for use in country where the logs have to be removed from steep hillsides. A 1½-in. steel cable is anchored to standing timber on the crest of the hill, the other end being fastened to the hoisting drum of the donkey. This cable may be carried out a distance of 4000 ft. under favorable conditions; that is to say, where the weight of the trailing logs will not cause too great a sag.

A carrier or trolley attached to an endless line brings in the logs, clearing the entire hillside within the limits of its travel.

When one portion has been cleared the main cable is moved to a new location, and so on until a radius of from 3000 to 4000 ft. has been cleared of timber. The logging engine may remain in one place for two

11000-550 Volt Transformer Car with Flexible Armored Triple Conductor Cable to Hoisting Machine. Cable Shown at Rear of Car.

Log Carrier.

[1]Paper presented at the 285th Meeting of the American Institute of Electrical Engineers, Vancouver, B. C., September 9-11, 1913.

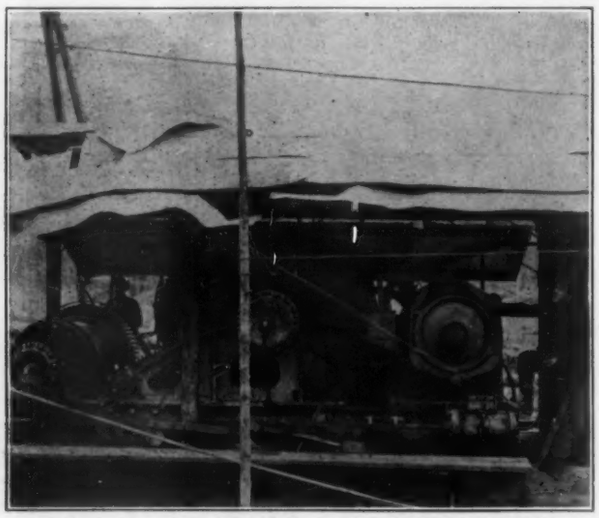
or three weeks, and thus save the expense of moving continually, which the older method of ground haulage involves. Also the logs are in much better condition for the sawmill when they have not been hauled bodily over the gravel and rocks. Pieces of gravel in the

11000-550 Volt Transformer Car.

latter case are embedded in the bark with disastrous results to the saws when they come in contact with them.

The skyline method permits of much faster handling, as the logs, having only one end trailing, are not likely to encounter obstacles.

The electrical equipment of each machine consists of one 150-h.p., 550-volt, 600-r.p.m., 60-cycle, 3-phase wound-secondary logging type motor, equipped with a solenoid brake. The motor is totally enclosed and of



Drums and 150 Horsepower Variable Speed Motor With Solenoid Brake.

very substantial construction to withstand the exceedingly hard service the work involves. The control consists of a seven-point controller connected to a bank of resistance grids located in the rear of the skids on which the machine is mounted. The controller also operates the primary circuit, making the drive self-contained.

As a safeguard a time element oil circuit-breaker switch is also installed, together with an ammeter

Starting to Haul In.

mounted in view of the operator, who is thus able to determine the safe stresses he can place on the steel cable. In practice it has been found that the cable is the weak link in the chain, the motor being able to take care of any and every load applied so far.

The brakes are operated by air from a compressor driven by a 7½-h.p. motor. Compressed air also operates the signal whistle, an important feature of logging equipments, as in most cases of long haulage the operator cannot see the load on starting, but must depend on signals, given by the hook tender, as to what he has to do.

Power is transmitted at 11,000 volts from the sawmill power plant located 3½ miles from the present logging operations. Portable substations mounted on flat cars, as shown in the illustration, step the voltage down to 600. Power is then supplied to the motors by triple-conductor No. 000 cable, steel armored, and lead covered. Expulsion fuses and horn-gap arresters protect the primary side of the 200-kw. 3-phase oil-cooled transformers.

The line construction has been made as simple as is compatible with safety, and inclusive of all charges, clearing right of way, material and labor, but cost of land not included, amounted to $767 per mile.

The illustrations show the general contour of the country in which these operations are being carried on, and also why it is unnecessary to make frequent changes of location for the logging engine.

The average daily haul for the month of April this year was 33,000 ft. for No. 1 donkey; an excellent showing, everything considered. On May 13th the machine under test brought in 55,000 ft. of logs, establishing a record. When certain mechanical defects in the equipment have been rectified it is expected that this record will be exceeded.

The rate of travel of the trolley at present is 1000 ft. per minute, hauling in an average load of

1700 log ft. It is expected to increase this rate of travel to 1200 ft. per minute on the new carrier shortly to be placed in operation.

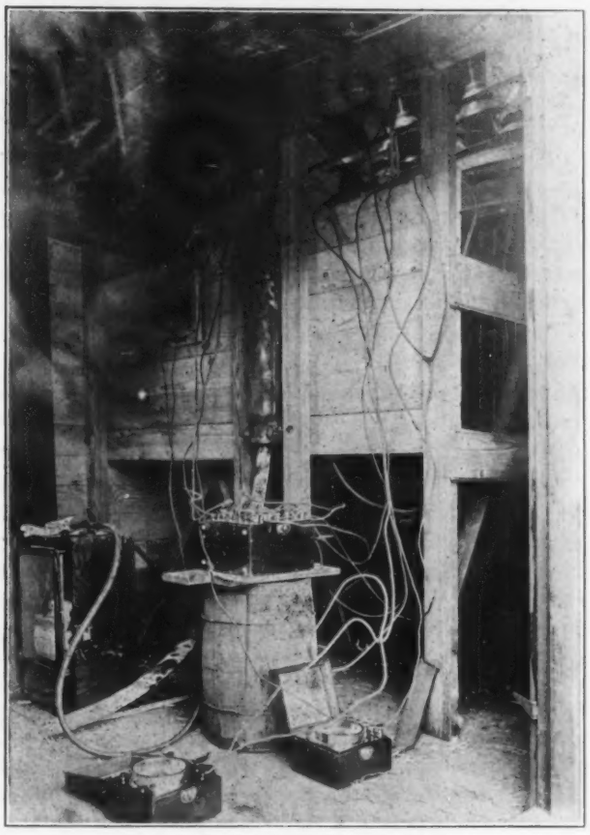
It is to be remembered that the white pine logs in this district are small compared to the fir and cedar of the Coast timber, where the distances hauled would have to be shortened considerably.

For the test a curve-drawing wattmeter was used with an indicating wattmeter as check; an ammeter and a voltmeter were used to check power factor.

Running out light, the carrier showed an average power input of 63 kw.

Hauling in logs scaling 1000 to 1500 ft. showed an average power input of 104.1 kw.

Loading logs on cars averaged an input of 80 kw. Power factor equaled 68 per cent, average.



Interior of Car During Tests.

A decided saving in time and power consumption would be effected by using a separate mortor and light hoisting apparatus for loading and so permit loading and handling at the same time. At present the one hoist has to do duty for both operations, for which it is not suited. A 50-h.p. motor would have ample capacity for loading logs either on rollways or cars.

The advantages of electric over steam haulage can be summed up briefly:

No fuel required, with consequent wastage of good lumber, averaging about 1000 ft. per day for each engine.

Elimination of fire risk in the forest.

Lower labor costs; no firemen or wood cutters required to supply fuel.

No freezing of boiler tubes in winter and consequently no charge for night watchman in cold weather.

Maintenance costs less than with steam; boilers have to be washed every two weeks and engines with reciprocating parts are harder on upkeep.

No water required. This is often a serious item, it being necessary in many cases to pump water for a distance of two miles.

No delays to get up steam and no shutdowns through failure of pressure, a frequent happening on long hauls.

No danger of boiler explosion.

Greater adaptability in regard to speeds, which can be increased beyond standard engine speeds at present in use.

The output of each machine can be standardized readily.

The output of steam donkeys will vary in ratio to the attention paid to proper firing.

It is estimated that a saving of at least 50 cents per thousand would be effected.

During 1911 the St. Paul & Tacoma Lumber Company, between contracts and camps hauled 81,000,000 ft., log scale. On combined operations the gross saving would be $40,500, from which the cost of energy would have to be deducted. Our records on the Potlatch test average 10 kw.-hr. for each 1000 ft. logged. This varies somewhat, but is sufficient for practical purposes.

This 810,000 kw.-hr. per year at the rate of 1.5 cents equals $12,150; and $40,500, minus $12,150, equals $28,350 saving effected, even at a minimum of 50 cents per thousand. The saving in elimination of one of the gravest fire risks can hardly be estimated in dollars and cents, but would pay a heavy interest, without any doubt.

The Smith Powers Co., of Marshfield, Ore., will have its electric logging engines in operation this summer, when data dealing with Coast timber will be available.

The development of logging by electricity will provide a valuable load from the central station point of view, especially on the Pacific Coast, where transmission lines from hydroelectric plants pass through extensive logging areas. Naturally it is an off-peak load and is continuous enough to be well worth trying to secure.

Thanks are due to Mr. A. W. Laird, general manager of the Potlatch Lumber Company, for the courtesy and assistance rendered in making the test.

High-Power Telescopes in Fire-Lookout Work have been found by forest officers to be not always satisfactory. In some localities heat vibrations in the atmosphere are so magnified by the glass that clearer vision can be had with the unaided eye.

At the National Conservation Congress to be held in Washington, November 18-20, the subject of forestry will be handled by a main committee, with subcommittees, which will report on federal and state forest policies, forest taxation, fires, lumbering, planting, utilization, forest schools and scientific forest investigations.

MOUNTAIN RAILWAY ELECTRIFICATION.

A Study of the Tehachapi Pass.

BL ALLEN H. BABCOCK.

During the past ten years the Southern Pacific Company has investigated the question of electrification of its three outlets from the central valleys of California, north, over the Siskiyou, east, over the Sierra, and south, over the Tehachapi. The earlier reports, inspired directly or indirectly by manufacturers as a part of their propaganda program, were favorable to electrification. The railway company then began studies of the subject, independently. The conclusions of its officers were unanimously opposed to electrification, by reason of the financial results to be anticipated; however, some of its lines have been electrified, and other electric lines have been acquired for good reasons.

Lately there has been a constant and persistent pressure put upon the company officials, by both power companies and consulting engineers, to reconsider decisions adverse to electrification, decisions that were made after patient and thorough study, and in the face of the fact that to be connected with any such important engineering work as these installations would be, could but fire the professional imagination of any engineer worthy of the name. Just how much of this agitation has been due to the application of general statements regarding the benefits to be secured by electrification, to the particular problems presented by west coast mountain railroading, is hardly susceptible of direct determination. It is possible, however, that much of it is due to the effect that such hypothetical studies and papers as have been published recently, have produced upon executives, who, however skilled they may be in their specialties, only in rare instances are sufficiently experienced technically to be capable of forming independent opinions on engineering matters. It is a fact that reports adverse to electrification in the hands of these same executives, often cause disappointment and sometimes arouse criticism.

Here, then, are two opposing parties; the one with things to sell, (apparatus, power, engineering skill), the other with a service to be maintained, at decreased cost if possible, but maintained at any cost it must be: the first reports favorably upon projects that the second considers unfavorably with equal positiveness. Some things must be unknown to both. Either the radicals have not all the facts upon which to work, or the conservatives cannot interpret their facts correctly.

Words have been multiplied with reference to the subject until aspiring authors well may pause before adding fuel, not to say fat to the fire; but it is with these thoughts in mind this paper is written, not with the intent to offer anything original in the study of such problems but to give the facts of a typical west coast mountain railroad district and their interpretation as seen by one whose reports heretofore have been responsible for many adverse decisions in such matters.

[1]Paper presented at the 285th meeting of the American Institute of Electrical Engineers, Vancouver, B. C., September 9-11, 1913.

It is not intended to be the final word on the subject of electrification of this district, but it is the result of a study recently made to determine whether there was such a reasonable chance for profitable electrification as would warrant a very considerable expense in time and money, such as was incurred a few years years ago in an exhaustive and final study of the Sierra problem, for example.

If through the facts given herein, and in the discussion thereof, a better mutual understanding will be reached, its purposes will have been served.

Physical Characteristics.

West Slope, Bakersfield to Summit .....49½ miles
Vertical rise .....3764 ft.
Average grade .....1.44 per cent
Average curvature equal to a constant 3 deg. curve.
Total curvature, 7944 deg., of which 6969 deg. are between Caliente and Summit (27.2 mi.). The loop curve has a total curvature of 566 deg. 33 min. 12 sec.
East Slope, Mojave to Summit.....18.3 miles
Vertical rise .....1285 ft.
Average grade .....1.33 per cent
Average curvature (as above).....0.79 deg.
Total curvature .....765 deg.

The ruling grade on each slope is 2.2 per cent, but these grades are not compensated for curvature so that in effect the ruling grade is 2.4 per cent. The maximum grades are long enough to fix the weight and power of the locomotives. The average distance between sidings is three miles, approximately.

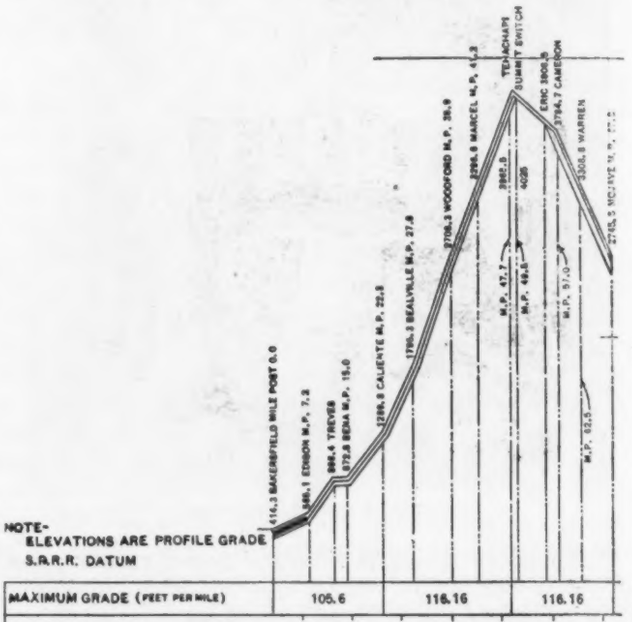


Fig. 1. Condensed Profile, Tehachapi Pass.

In determining energy consumption of trains moving over the mountain the actual characteristics of the line were used, but in determining load diagrams and substation spacings and capacity, the following close approximations were made to take care of the ruling grade, curves, etc.

Section.	Miles.	Average grade
Bakersfield to Edison	7.2	0.5 per cent
Edison to Caliente	15.1	1.5 per cent
Caliente to Summit	27.2	2.4 per cent
Mojave to Cameron	10.8	2.4 per cent
Cameron to Summit	7.5	0.75 per cent

The average freight train, eastbound, weighs 2000 tons, exclusive of locomotives. Four consolidation type locomotives, or their equivalent in Mallet compounds, are used to haul this train from Bakersfield to Summit. From Summit to Mojave one locomotive is used for supplying air for brake purposes, etc., and the other three return deadhead to Bakersefield. The westbound freight trains are lighter than the eastbound on account of the fact that much of the western movement consists of empty cars. The normal weight is 1250 tons, hauled by three consolidation locomotives, or their equivalent Mallets; or a 1500 ton train operated by three consolidation or decapod locomotives, or their equivalent in Mallets. The helper engines cut out at Summit and return light to Mojave.

In order to provide a flexible unit it was proposed to use an electric locomotive, capable of handling a train unit of 500 tons, as many per train to be used as the weight of the train requires. The weight of the electric locomotives is assumed at 100 tons.

Passenger train weights vary from 250 tons to 600 tons, for which a single passenger locomotive weighing 150 tons was provided. A maximum freight train movement over the mountain recently consisted of twelve full-size freight trains, eastbound, and eight full-size freight trains, westbound, in addition to the normal passenger movement, which is seven regular trains each way per day, with occasional extras and second sections.

The track, particularly on the west slope, is laid for the greater part of the distance in rough country, in fact between mile posts 326 and 361 all the track, with the exception of a short stretch near Caliente, is in cuts or on fills. It may be said generally that at least half the track is laid in conditions where any overhead contact system would require necessarily, very expensive steel pole or bridge construction. In addition to the above, there are 18 tunnels, in one of which the vertical clearance is more than 18½ ft., and 60 per cent of their total length is on 10 deg. curves.

Experience with similar earlier reports has shown that, in general, there is little difference in total first cost and annual operating costs, whether an overhead system or the third rail system be considered. A double overhead contact system gives maximum first cost and operating costs for contact system, and minimum weights, costs and maintenance of locomotives; a single overhead contact system gives high first cost and operating costs for contact system, with maximum weights and maintenance of locomotives; the third rail gives high first cost and minimum operating cost of contact system, medium locomotive weights and first costs, with minimum operating costs, but the total costs are brought up to the level of the others by reason of the necessary substation apparatus and attendance. A choice of systems therefore is to be made only after an exhaustive study of all the local conditions.

In a preliminary study, as this is, it matters little what particular system of propulsion is chosen upon which to base the estimates. For the purposes of this discussion a 2400-volt continuous current, third-rail contact system was selected for the main line, with an overhead contact system in yards and terminals, at Kern, Bakersfield and Mojave.

In the following the first costs are based on the present traffic as shown by the train dispatcher's sheets; the annual operating costs are taken from the reports of the fiscal year ending June 30, 1912, for steam operation, while the same traffic and reports are used, as far as they apply, in estimating the costs for electric operation.

First Costs.

Substations	$1,610,000
Generating station	1,760,000
Transmission system	430,050
Contact system (yards)	155,250
Contact system (line)	825,000
Bonding	122,300
Block signals	175,000
Shops and inspection shed	10,000
Electric locomotives	2,085,000
Total	$7,172,600
Credit by steam locomotives released for service on other divisions	1,464,900
Net first cost	$5,707,700

Annual Operating Costs.

(Steam-generated power)	Steam.	Electric.
Substation labor and supplies		$ 59,700
Power house labor and supplies		84,780
Transmission and contact system maintenance		36,576
Maintenance of way as affected by locomotives	$126,890	83,285
Locomotive repairs	270,990	70,701
Locomotive enginemen, (passenger)	48,300	29,100
Fuel	240,852	100,530
	$687,032	$464,672
Bond interest at 4½ per cent		256,847
Totals	$687,032	$721,519

Net loss, $34,487.

In the above no account is taken of items not affected by character of motive power: freight enginemen, and all train crew wages, repairs to cars and maintenance of way as affected by cars—for example.

The net loss under proposed electric operation is so small that it might be wiped out by a reasonably small change in the assumptions; in fact, at this stage of similar investigations often there is a temptation to search for opportunities to change this, or to modify that, as the necessities of the case demand. This important fact should be borne in mind, however, that in the foregoing no account is taken of taxes and depreciation, both of which must be paid, some time, by some one, to the extent of at least 5 per cent of the net investment, which increases the net loss by approximately $285,000 per year.

It may be asked why is depreciation not taken into account in the usual manner? The answer is, since there is a loss, or at least no profit shown, and since to add depreciation would be to make a bad matter only worse, nothing is to be gained by entering into the academic discussions that inevitably follow the opening of a subject concerning which opinions reasonably may differ as widely as on this much disputed particular.

But power may be purchased, as is often suggested by those with power for sale; hence it is proper

to determine at what rate this power may be purchased and come out even as compared with operation by steam-generated power. Obviously any rate less than this will be profitable.

With purchased power, the total investment will be diminished by the costs of 20 miles of transmission line and of the generating station, it being assumed that power will be delivered at some one point on the right-of-way, whereas local conditions located the steam station 20 miles off the right-of-way.

The net first cost was		$5,707,700
Transmission line	$ 120,000	
Generating station	1,760,000	1,880,000
Leaving a net investment with power purchased		$3,827,700

Annual Operating Costs. (Power purchased)	Steam.	Electric.
Substation labor and supplies		$ 59,700
Transmission and contact systems maintenance		35,576
Maintenance of way as affected by locomotives	$126,890	83,285
Locomotive repairs	270,990	70,701
Locomotive enginemen, (passenger)	48,300	29,100
Fuel	240,852	
	$687,032	$278,362
Bond interest at 4½ per cent		172,247
Totals	$687,032	$450,609

The difference, $236,423, should be decreased by $191,385 (the approximate tax and depreciation rate of 5 per cent on the net investment of $3,827,700); and there is left the wholly inadequate sum of $45,038 with which to purchase 53,000,000 kw-hr. at a load factor of about 20 per cent, with no profit to show for an investment of nearly $4,000,000.

For the sake of the argument, let the depreciation be neglected and let it be considered that $236,423 are available for the purchase of power under the operating conditions of the service. At any time there may be four passenger and four freight trains pulling uphill simultaneously, taking a total of 32,720 kw. alternating-current input to the line. This is not the maximum number of trains that is on the mountain regularly, but represents only those taking power. A slight derangement of schedules, or an extra freight movement, citrus fruits or oil, or a blockade, for example, will cause congestion beyond any possibility of estimating. This traffic must be handled as circumstances require. It cannot be spaced conveniently for power demands, as many engineers and power men have suggested, but the terminal yards must be cleared as the cars accumulate. Is there any power company in the west coast country, or even beyond the reach of such a natural power source as Niagara, that would care to undertake such a load for any such yearly return as that named in this paragraph? It would net about 4½ mills, a rate that neither the purchaser nor the seller could afford to consider.

In the face of the foregoing it is difficult to see how any recommendation in favor of electrification can be made, if the opinion is based on the direct financial profit to be realized; in other words, this case is merely another example of the fact often noted that in the great majority of cases the profits from electrification must be realized indirectly rather than directly—increased track capacity, postponing second or double-tracking, or the like.

It may be urged that a larger district would make a better showing. In this connection it may be noted that the line from Bakersfield to Summit is almost identical with half of the line assumed in Mr. Hobart's paper on "2400-Volt Railway Electrification." On each side of the summit Mr. Hobart's assumed line is 3800 ft. rise in 48 miles, with the ruling grade of 2.2 per cent, while the west slope of the Tehachapi is 49½ miles, rise of 3764 ft. and a ruling grade of 2.4 per cent. Also Mr. Hobart assumes freight train weight on heavy days of 1800 tons, as against 2000 tons on the Tehachapi. Furthermore, the Sierra study covered a district more than double the length of the Tehachapi, and the result was the same.

HYDRAULICS—IV.

BY OTTO B. GOLDMAN.

Special Cases and the General Equations for Internal Power Loss.

In the second article we found by equation (34) that the loss due to internal friction

$$L = \phi\theta^2 (s_2^2 - s_1^2) \text{ per unit of depth.}$$

Let us now extend this case to that of the standard elbow, that is one of constant radius of curvature with fixed center and circular cross-section. For a depth dx we have

$$dL = \phi\theta^2 (s_2^2 - s_1^2)\, dx \quad \ldots\ldots (36)$$

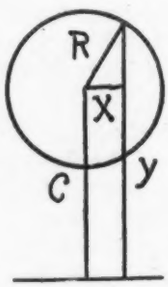


Fig. 3.

In Fig. 3, let R be the radius of the section, and c the mean radius of curvature. For simplicity let us put

$$s_2 = y.$$

$$\text{Then } s_1 = y - 2(y - c)$$
$$= 2c - y$$

We have also

$$(y - c)^2 + x^2 = R^2 \quad \ldots\ldots (37)$$

Substituting in eq, (36), we get

$$dL = 4c\phi\theta^2 (y - c)\, dx \quad \ldots\ldots (38)$$

But by eq (37)

$$(y - c) = \sqrt{R^2 - x^2}$$

Whence

$$dL = 4c\phi\theta^2 \sqrt{R^2 - x^2}\, dx \quad \ldots\ldots (39)$$

Which by integration gives

$$L = 4c\phi\theta^2 \left[-\frac{x}{2}\sqrt{c^2 - x^2} + \frac{c^2}{2}\sin^{-1}\frac{x}{R} \right]_{-R}^{+R}$$

and putting in the limits we get

$$L = 4c\phi\theta^2 \left[R\sqrt{c^2 - R^2} + c^2 \sin^{-1}\frac{R}{2} \right] \quad \ldots\ldots\ldots (40)$$

Equation (40) is the general equation of the loss in an elbow, due to internal friction. If the bend is 90 degrees, then θ becomes $\frac{\pi}{2}$. An examination of this equation, shows that the loss tends to increase, with the increase of the radius of curvature. The reason for this is that the loss depends not only on the slippage, but also upon the areas involved. Where the limit is beyond which we should not increase the radius of curvature of a bend, can only be determined experimentally. However, it is interesting to note that the principal loss in a bend is due to internal friction, a matter that has apparently been entirely overlooked. We will have to take up this proposition further, when we take up the subject of the interrelation of the external and internal friction. This subject has important applications in hydraulic design.

We will take up next, the general equations of the slippage and internal friction loss.

By equation (22) we have for the radius of curvature

$$p = \frac{v^2}{\frac{d^2s}{dt^2}}$$

Substituting for $\frac{d^2s}{dt^2}$, its value as given in eq (26), we get

$$p = -\frac{v^2}{K^2Q_0^2} \cdot \frac{s^3 \left[f^1\left(\frac{s}{k}\right) \right]^3}{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)} \quad \ldots\ldots\ldots\ldots (41)$$

In passing from one streamline to the adjacent, we have K for the variable, whence we have under these conditions

$$dp = -\frac{v^2}{K^2Q_0^2} Dk \frac{s^3 \left[f^1\left(\frac{s}{k}\right) \right]^3}{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)} dk \quad \ldots (42)$$

For the slippage, we have

$$d^2Z = dp\,d\theta \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (43)$$

Where $d\theta$ is the angle subtended by the arc dr, whence

$$d^2Z = \frac{dp\,dr}{p} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (44)$$

Substituting for p and dp its values as given above, and for dr its value $f^1\left(\frac{s}{k}\right) ds$, we get

$$d^2Z = \frac{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)}{s^3 \left[f^1\left(\frac{s}{k}\right) \right]^3} Dk \left\{ \frac{s^3 \left[f^1\left(\frac{s}{k}\right) \right]^3}{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)} \right\} dk\,ds$$

Whence by integration we get for the slippage

$$Z = \int\int \frac{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)}{s^3 \left[f^1\left(\frac{s}{k}\right) \right]^2} Dk \left\{ \frac{s^3 \left[f^1\left(\frac{s}{k}\right) \right]^3}{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)} \right\} dk\,ds$$

$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (45)$

The areas in contact per unit depth are equal to dr, whence the loss is

$$L = \int\int\int \phi \frac{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)}{s^3 \quad f^1\left(\frac{s}{k}\right)} Dk \left\{ \frac{s^3 \left[f^1\left(\frac{s}{k}\right) \right]^3}{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)} \right\} dk\,ds\,ds$$

$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 46)$

thus obtained in eq (54) the general equation for slippage and in equation (55) the general equation of the resultant power loss.

We are using in all these calculations, curvilinear co-ordinates, because they are natural co-ordinates for the physical conditions involved. They therefore give simpler results and these are more easily interpreted. They can readily be transformed into rectilinear co-ordinates by the following transformations:

$$x=\int \frac{ds}{\sqrt{1+[f'(\frac{s}{k})]^2}} \quad \ldots\ldots (47)$$

$$y=\int \frac{f'(\frac{s}{k})\,ds}{\sqrt{1+[f'(\frac{s}{k})]^2}} \quad \ldots\ldots (48)$$

Thus if we have $r=m\frac{s}{k}$ ..... (49)

Where m is a constant, we get

$$x=\int \frac{ds}{\sqrt{1+\frac{m^2}{k^2}}}=\frac{S}{\sqrt{1+\frac{m^2}{k^2}}}$$

and

$$y=\int \frac{\frac{m}{k}ds}{\sqrt{1+\frac{m^2}{k^2}}}=\frac{\frac{m}{k}S}{\sqrt{1+\frac{m^2}{k^2}}}$$

Whence

$$y=\frac{m}{k}x \quad \ldots\ldots (50)$$

This gives for streamlines, a pencil of straight lines.

Or, again, if we have

$$r=a\frac{s^2}{k^2}+c\frac{s}{k} \quad \ldots\ldots (51)$$

Where a and c are constants, we get

$$x=\frac{k^2}{2a}\log\left[\frac{2a}{k^2}s+\frac{c}{k}+\sqrt{1+(\frac{2as}{k^2}+\frac{c}{k})^2}\right] \quad (52)$$

and

$$y=\frac{K^2}{4a}\sqrt{1+(\frac{2as}{k^2}+\frac{c}{k})^2} \quad \ldots\ldots 53)$$

From which we get

$$(1-e^u)^2=4e_u\left(\frac{16a^2y^2}{K4}-1\right) \quad \ldots\ldots (54)$$

Where exponent $u=\frac{4ax}{K^2}$.

We can readily get the value of the normal force for the relation expressed by equation (51), by substitution in eq. (30). This gives

$$P_n=\frac{W k^2 Q_0^2}{2g}\left[\frac{1}{b^2[\frac{2ab}{k^2}+\frac{c}{k}]^2}-\frac{1}{s^2[\frac{2as}{k^2}+\frac{c}{k}]^2}\right] \quad (55)$$

For any fixed value of k, this equation gives us the variation of P_n along a streamline; for both s and k variable, it gives us the value of P_n anywhere in the plane. This or any of the equations in r and s given can readily be transformed into rectilinear co-ordinates if desired.

TO ELECTRICITY.

By thy swift power a human life may be
Destroyed or saved in one brief instant, and
The labor that is hourly done by thee
Would tire a million men, if done by hand.
I hail thee as one of the greatest powers,
Submissive to control by mind of man.
Each year, in this great, wondrous world of ours,
New gulfs en route world-progress thou both span.

—Chas H. Meiers.

GOVERNMENT CO-OPERATES IN TIMBER SALE.

Co-operative arrangements announced by the departments of agriculture and the interior make possible the offering for sale of 630 million feet of merchantable timber in Southeastern Arizona.

The stand covers the southeastern corner of the Sitgreaves national forest, the northwest edge of the Apache national forest and the Fort Apache Indian reservation. Besides 600 million feet of yellow pine timber, there is 30milllion feet of less important species, including Douglas fir, white fir, Engelmann spruce, Mexican white pine, blue spruce and cork bark fir.

Separate bids and contracts must be made for the timber upon the national forests and that upon the Indian reservation. Ten years will be allowed for the removal of the timber after the beginning of the cutting period, although a sufficient period will be given first for the construction of logging roads, mills, etc.

The opening up of this great body of virgin timber, is due to the determination of the departments of the interior and agriculture to pool their acreage in the locality described. By combining timber on the two adjoining national forests, the Apache and the Sitgreaves, with the stand on the Fort Apache Indian reservation, a natural logging unit of sufficient timber is presented to warrant the extensive and costly constructive work which the marketing of the timber requires.

PACIFIC COAST A. I. E. E. CONVENTION.

The fourth annual Pacific Coast convention of the American Institute of Electrical Engineers convened at Vancouver, B. C., September 9-11, 1913. While somewhat more limited in attendance than some of its predecessors from many standpoints, it was the most successful yet held, particularly as regards the value of the excellent discussion made possible by considering but one paper at a session. The total registration was 154, of which one-third came from outside points.

The first session on Tuesday afternoon was opened by an address of welcome by a representative of Vancouver's Mayor. Chairman R. F. Haywood then introduced Vice-President J. A. Lighthipe who hereafter presided at all meetings.

In the absence of the author, V. M. Greisser's paper on **"Snow and Ice Loading on Transmission Lines,"** was read by C. F. Uhden. An abstract of the paper follows:

Wires hung from suspension insulators do not maintain their relative positions as closely as when pin type insulators are used, owing to the deflection of the insulators with unequally loaded spans. During the winter season a transmission line of the Washington Water Power Company was rendered almost useless due to short circuits caused by the stretching and sagging of the wires when unequally loaded with ice, which falls from some spans sooner than others.

A series of tests upon an experimental line was made to determine (1) the influence of the loaded line upon the elasticity of the cable; (2) the effect of swing of insulators; (3) the effect of using strain insulators at short intervals, and (4) the combined effect of these conditions.

The manner of making the tests is described and the results are shown graphically, the conclusion being that the conductors should not be placed in a vertical plane and also that even if arranged horizontally the conductors will sag within unsafe distances of the ground. It is recommended that high voltage insulators should be shortened, spans shortened and transmission lines built with disregard to all the stresses which will develop in the supporting structures and conductors.

The discussion was opened by J. B. Fisken who emphasized the fact that the engineer should inform himself on the method of formation of sleet and frost and so anticipate possible trouble.

F. D. Nims told of experience with snow in heavily forested sections whereas in non-protected areas little difficulty was experienced. R. F. Haywood suggested that pin type insulators, being rigidly supported, caused less trouble than the flexible suspension, though Paul Lebenbaum believed that the electricity of the wire was also a contributory factor. W. V. Hunt suggested that damage could be obviated by a shorter spacing of towers, more frequent dead-ending and also by lengthening the center cross arm. T. R. Cornick corroborated these statements, but questioned the advisability of using suspension insulators for short lines of less than 60,000 volts. Chairman J. A. Lighthipe stated that the experience of the Southern California Edison Company had demonstrated the superiority of the suspension type which were gradually being used to replace all pin insulators on their 75,000 volt line, the pin type cracking after four or five years' service. A. A. Miller also cited the success of the Montana Power Company with the pin type.

F. D. Nims suggested that a combination insulator, such as that made by the Pearson Engineering corporation, seemed to promise well. J. B. Fisken stated that spans were entirely too long, unless higher towers and stronger wire were used. V. Karapetoff stated that the factor of safety in a transmission line was not large enough to insure continuity of service, these statements being challenged by A. H. Babcock, because the reliability resulting from extreme engineering care is seldom justified by the subsequent earning capacity.

A. H. Babcock's paper on **"Mountain Railway Electrification"** is published in full elsewhere in this issue. An appendix comprising a convenient and quick method of determining the feeder and substation layout in preliminary studies was developed by F. E. Geibel, other appendices showing the details of generating station costs and other features more briefly summarized in the report, G. W. Welsh also having collaborated in their preparation.

Chairman J. A. Lighthipe told of the entire change in Mr. Babcock's opinion as to electrifying the Sierras since the first study of the problem. The discussion related chiefly to the relative efficiencies of oil fuel and the possibility of future electrification. The former was participated in by A. A. Miller, H. W. Beecher and the authors, the latter by J. R. Fisken, Paul Lebenbaum, R. F. Haywood, V. Karapetoff, J. A. Lighthipe and the authors, somewhat along the lines suggested in an editorial in this issue.

E. P. La Belle and L. P. Crim presented a paper describing the construction and laying of **"The Gulf of Georgia Submarine Telephone Cable,"** a continuously loaded submarine telephone cable between points near Vancouver and Nanaimo,, a distance of 14.2 miles. After a careful study of the relative advantages of a continuously loaded and a coil loaded cable for these special conditions, the results have justified the selection of the continuously loaded type. This paper and discussion will be published in an early number of this journal.

On Wednesday evening Vladimir Karapetoff, professor of electrical enginering at Cornell University, gave a musical recital and interpretation which was greatly enjoyed by all present. A. H. Halloran showed a large number of lantern slides of the "Engineering Features of the Panama-Pacific Exposition" as an accompaniment to a lecture on the subject. This evening meeting was held in the rooms of the Progress Club, a supper being served at the conclusion.

On Thursday morning John B. Fisken presented **"A Modern Substation in the Couer D'Alene Mining District,"** as built by the Washington Water Power Co. to supply three-phase power at 2300 volts to the Bunker Hill and Sullivan mines. The paper gave a detailed account of all the euipment and cost of a structural steel portable station supplying 3000 h.p. to various motors at the mine. A table of distribution of cost of electric light and power for the average month is given which shows the cost of this service for different mines operated.

Much of the discussion centered around the adaptation of such portable substations to other industries. F. D. Nims questioned the use of three-phase rather

than single phase transformers. R. F. Haywood emphasized the influence of the exacting service demanded from mines in creating improved design for other requirements. F. B. Fisken explained that the saving in weight and in space justified the use of three phase transformers, especially under the difficult conditions of transportation in this instance. He stated that the prime reason for adopting Y-connection was that it reduced the strain on all apparatus.

In the absence of the author, K. C. Randall's paper on **"High Voltage Circuit Breakers"** was read by A. A. Miller. This paper showed the details of construction and operation of a switch wherein a reactance was introduced to limit the current to a value readily ruptured.

This paper was discussed by L. G. Robinson, J. B. Fisken, W. W. Fraser, V. Karapetoff and A. A. Miller.

In the absence of E. J. Barry his paper on **"Logging by Electricity"** was read by Mr. Herring, who also introduced the discussion by giving many facts and figures upon the use of electricity in the lumber industry. These were supplemented by much interesting information from E. F. Whitney, all of which will be printed herein as soon as available. As this concluded the list of papers the technical sessions were declared closed.

Entertainment Features.

On Thursday evening a magnificent banquet was served in the Terminal City Club, which institution had also extended all its privileges to the visiting engineers. By the American visitors the showing of true Canadian hospitality was deeply appreciated and will long be remembered. During the evening it was unanimously decided to recommend that the next Pacific Coast convention be held at Spokane, Wash., at the time of the Northwest Electric Light & Power Association's meeting.

R. F. Haywood presided and introduced the various speakers, whose remarks all sparkled with humor and epigrams.

Following is the toast list:

"THE KING."

"THE PRESIDENT OF THE UNITED STATES."

"THE PROVINCE OF BRITISH COLUMBIA."
Proposed by Mr. William McNeill.
Responded to by Mr. H. H. Stevens, M. P.; Mayor Baxter.

"AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS."
Proposed by Mr. R. F. Hayward, Mr. R. H. Sperling.
Responded to by Mr. J. A. Lighthipe, Mr. A. H. Babcock, Mr F. L. Hutchinson.

"KINDRED SOCIETIES."
Proposed by Mr. R. W. Pope.
Responded to by Mr. G. R. G. Conway.

"THE TECHNICAL PRESS."
Proposed by Prof. Karapetoff.
Responded to by Mr. A. H. Halloran, Mr. N. A. Bowers.

"GOD SAVE THE KING."

On Friday the delegates were the guests of the Western Canada Power Coompany while visiting their new power plant at Stave Falls. After a pleasant ride by rail and an inspection of the plant a sumptuous lunch was served. In the afternoon the party enjoyed a boat ride on Stave Lake, greatly admiring the wonderful scenery en route. Upon returning tea was served, when the visitors expressed their hearty appreciation of the royal hospitality extended them by Mr. Haywood, Mr. McNeill, Mr. Nims and the other officials of the company.

On Saturday the British Columbia Electric Railway Company were the hosts on a steamer trip to the new Lake Buntzen plant on North Arm. Lunch was served in the high tension room while tea was served after the plant and lake had been inspected. This trip also was an inspiration to those fortunate to be present and it was unanimously and vociferously decided that nowhere have greater hospitalities been enjoyed than in British Columbia.

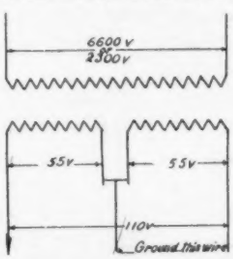
Thus was brought to a conclusion a convention which will long be remembered as a monument to the untiring members of the Vancouver section, whose several committees so thoughtfully anticipated every wish of the visitors. Particular credit is due to Chairman R. F. Haywood and Secretary E. M. Breed for the general arrangements as well as to F. D. Nims for the excellent papers.

STANDARD METHOD OF GROUNDING SECONDARIES OF TRANSFORMERS.

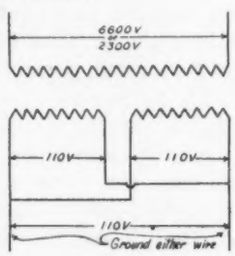
There has arisen a great demand for the diagrams showing the actual methods to be pursued in grounding transformers to comply with the new mandatory rule of the National Electrical Code Edition, 1913. Also a great many of the State Commissions are demanding grounding of the secondaries of distribution systems which intensifies this demand.

Through the courtesy of Mr. D. F. McGee, chief engineer of the Pacific Power & Light Company of Portland, Ore., the Journal has been given permission to print their actual drawings.

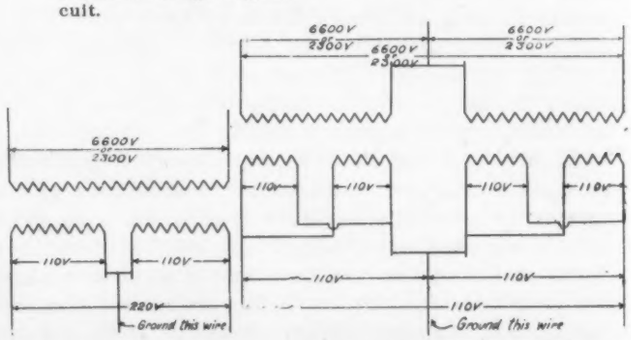
Grounding according to these methods outlined has been carried out in all of their properties in the northwest with satisfactory results.



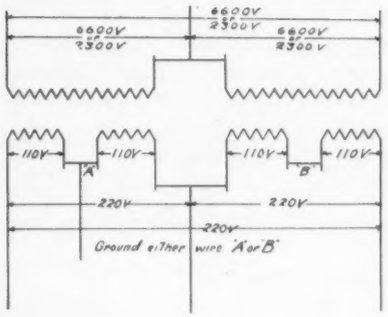
55/110-volt coils on 110-volt 2-wire lighting circuit.



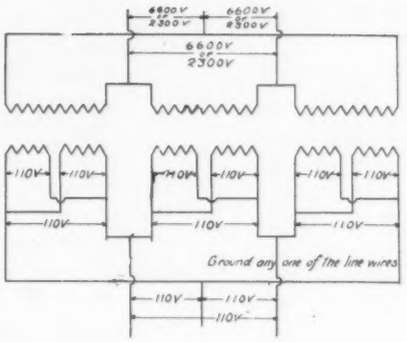
2-wire lighting circuit.



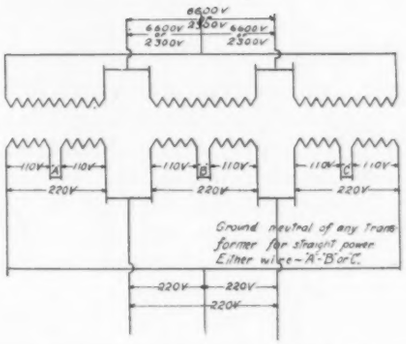
3-wire lighting circuit. 2 transformers banked for 110-volt, 3-phase, open-delta, light or power.



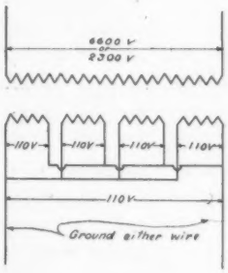
2 transformers banked for 220-volt, 3-phase, open-delta power. This also holds for light and power circuits where light is taken off transformer having grounded neutral.



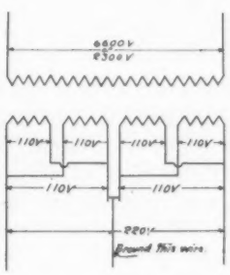
3 transformers banked for 110-volt, 3-phase, closed-delta—light or power. If used for power, and lights are also connected—preference should be given to one side of lighting circuit.



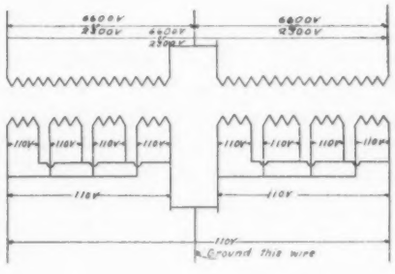
3 transformers banked for 220-volt, 3-phase, closed-delta power. Ground neutral of transformer which is supplying lights, and under no circumstances should more than one wire be grounded.



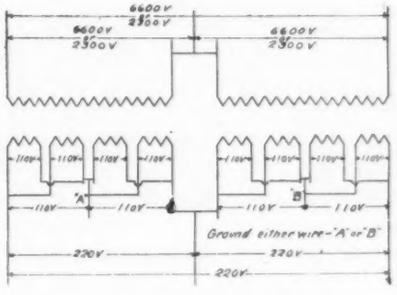
4 - coil secondary transformer on 2-wire lighting circuit.



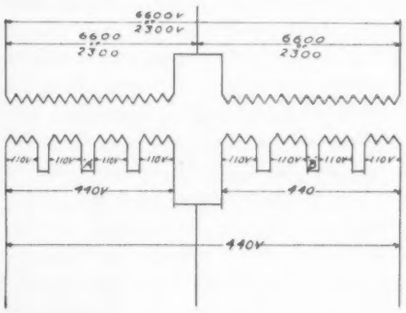
4 - coil secondary transformer on 3-wire lighting circuit.



4-coil secondary—2 transformers on 110-volt, 3-phase, open-delta, for light and power circuits.

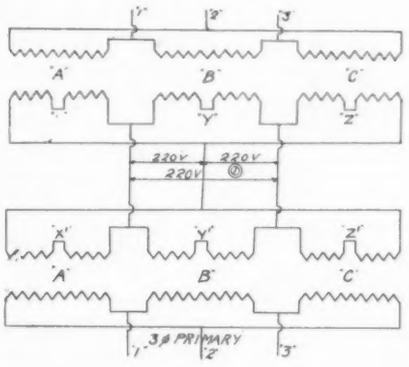


4-coil secondary—2 transformers on 220-volt, 3-phase power. If lights are also connected, ground neutral of transformer carrying lights—not more than one wire to be grounded.



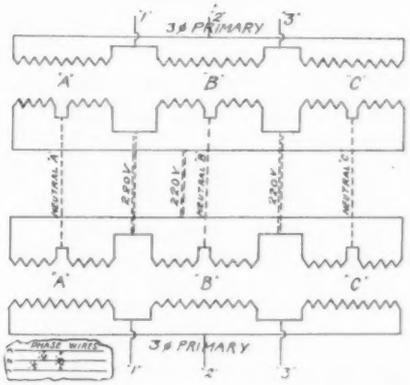
4-coil secondary—2 transformers on 440-volt, 3-phase power.

NOTE.—Grounding either point "A" or "B" will allow of a maximum voltage to ground of 380 volts. Danger from shocks to employees or others working on such circuits is **more** serious than the danger from the breaking down between primary and secondary, or crosses with high-tension lines. Therefore, circuits of this voltage **shall not** be grounded.



2 banks of 3 transformers connected for 220-volt, 3-phase, closed-delta power. Ground either point—x, y or z and the corresponding point on the other bank—x', y' or z'.

If for any reason any transformer in either bank is put out of service it will likely be necessary to change ground wire into secondary system. This change will require that ground tap be changed at each bank and care should be taken to maintain proper phase relations.



2 banks of 3 transformers connected for 110/220-volt, 3-phase, closed delta. If for any reason any one of the transformers in either bank be put out of service it will likely be found necessary to change ground wire to secondaries.

Neutral of transformer doing heaviest lighting duty should be grounded. If transformers are doing 220-volt, 3-phase power duty only, so that neutrals are not strung through, the neutral of same phase transformer should be grounded at each bank—not more than one wire to be grounded—and see that it is proper phase relation.

Standard Methods of Grounding Transformer Secondaries. Case to be grounded in every instance except as noted.

PACIFIC COAST GAS ASSOCIATION CONVENTION.

The twenty-first annual convention of the Pacific Coast Gas Association met at San Jose, Cal., on September 16, 17 and 18. After the usual business meeting on Tuesday morning President C. S. Vance presented the following address:

"Owing to the death of Mr. Henry E. Adams, whom we elected to the office of president at the last convention, it devolved upon me to take up the reins of the association, and to preside over the twenty-first annual convention, though it is with a feeling of deep regret that I do so under such sad circumstances.

"We meet today in a typically prosperous and rapidly developing California city, a city famed for its beauty and well deserving its title 'The Garden City.' In the name of the association, I thank the chamber of commerce and the citizens of San Jose for their hospitality.

"The real worth of a meeting of this character lies in the reports of what has been accomplished by the various committees during the past year, and in the different papers which are presented for consideration. Realizing this, and bearing in mind the fact that the technical and engineering branches of our industry will receive attention in these papers, I will but briefly touch upon a few important matters most vitally affecting the interests of our organization.

Gas Manufacture and Distribution.

"During the past year there has been a very noticeable increase in the number of central stations for gas distribution. The smaller companies have shown a tendency to either sell to or consolidate with larger concerns. This is of great benefit to the gas industry generally, as it tends to a betterment of service and a lower gas rate, and gives the consumer a superior and more even product. Again, it furthers the development of high pressure distribution and is instrumental in supplying, not only the smaller country towns, but farms and ranches wherever the lines pass, which would not otherwise justify service for many years to come.

"Development along purification lines seems to have been confined to efforts to eliminate naphthalene, the oil scrubber being adopted as the medium along the Pacific Coast.

"The disposition of carbon, the principal by-product of oil-gas manufacture, by means of mechanical separation and manufacture into either briquets for domestic fuel or bricks for fuel use in plants, has, during the last year, been adopted by a number of gas companies on the Pacific Coast. The Los Angeles Gas & Electric Corporation is the pioneer in this branch of the gas industry, and it is pleasing to see others profiting by its experience. Last winter, the demand for commercial briquets in Los Angeles was beyond all expectations and taxed to the utmost, the capacity of our transportation department.

"Regarding the gas generator, there seems to be a tendency toward the installation of larger units. Much study has been given to the reduction of manual labor, to the end that the operator may devote his energies to more intelligent supervision of the generators. This results in higher efficiency, both as regards oil consumption and maintenance of the generator in general.

"There have been some experiments to make oil gas under pressure, under the same theoretical conditions as now exist, except the increasing of the pressure to thirty pounds. To date, as far as I know, nothing worthy of mention has been established, as these experiments are yet in their infancy. However, the principles involved are correct and later developments may prove of great interest.

Natural Gas.

"Great progress has been made in the natural gas industry in California during the past year. The Midway Gas Company has completed a gigantic enterprise which bids fair to effect a great change in the gas business in and around Los Angeles. From the natural gas fields in the Buena Vista Hills, Kern county, to Los Angeles, a distance of about 120 miles, a 12 in. pipe line has been built, and huge compressors, to increase the carrying capacity of the line, are being installed. A number of gas wells have been completed and more are being drilled.

"As no papers are to be presented on natural gas, I think it might be well to say a few words regarding its use and the results obtained therefrom.

"The Los Angeles Gas & Electric Corporation is now using natural gas as fuel under its boilers and for heating the oil gas generators, and finds it very satisfactory, especially in the latter capacity. Here it has proven an ideal fuel for obtaining what is known as "surface combustion." This combustion, taking place above the firebox arches, further reduces the repair item to this portion of the generator. It has also been observed, in the use of natural gas for heating the generators, that it is possible to make a finer adjustment of heat, owing to the fact that the amount of blast can be properly regulated, this being possible because there is no smoke to contend with, as is the case when using fuel oil for heating. Further, it is easily possible to get a more even, or flexible, distribution of heat desired. The natural gas burner used in the generators is of the most simple construction, being nothing more than a two-inch standard wrought iron pipe with an ordinary regulating gate valve. This is connected to the generator, in place of fuel oil burner, alongside of blast nozzle. This gas contains about 1000 B.t.u. per cubic foot, according to recent tests, and a year's experience with this fuel should demonstrate its efficiency as compared with California crude oil.

Legislation.

Since the adoption in 1911 of amendment to Section 23 of Article XII of the Constitution of the State of California giving to the railroad commission certain powers of control over gas and electric companies and other utilities, there has been a growing sentiment in favor of the surrender to the commission of the power of rate regulation expressly retained by municipalities of the State under the constitutional provision. Several cities have already held special elections for this purpose, notably, Ualo Alto, Orange, Willits, Covina, Monterey, Salinas, Eagle Rock, Antioch, Ontario and Belvedere. Recognizing this condition, the legislature, at its recent session, proposed to the qualified electors of the State, a further amendment to this section of the

constitution giving the railroad commission additional power to regulate rates of such utilities in all municipalities throughout the state. This amendment is known as assembly constitutional amendment No. 62, and will come before the people at the next general election, or earlier should a special election be held at which such proposition could be submitted.

International Gas Congress.

"The invitation extended by our organization to the American Gas Institute asking that body to attend the International Gas Congress to be held in San Francisco in 1915, has been accepted, and the institute has taken charge of the issuing of invitations to the other gas associations. Most of these invitations have been accepted, and delegates have been appointed to the Gas Congress Committee. In view of the fact that these associations will meet in San Francisco as our guests, it is incumbent upon us to make their visit a memorable one, and in order to accomplish this, it is absolutely necessary that all the members lend their support and co-operation to this enterprise. There is considerable work to be done between now and the time of this meeting, and it behooves us all to put our shoulders to the wheel and do our utmost toward making a success of the most important project ever started by this association. Mr. E. C. Jones, our delegate to the Gas Congress Committee, will tell us in detail what has been accomplished by the committee since our last meeting.

Gas Engineering Course.

"It is indeed very gratifying to note the success which has met our efforts to establish a course leading to the degree of gas engineer in the University of California. During the past year, that institution has made the degree part of its curriculum, and reports indicate that the students are taking a lively interest in this study. This work has been well begun, and it rests wholly with the members of the association as to whether or not it will be pushed into a successful conclusion. I know that we will all be interested in hearing more about this great undertaking for which the association is responsible, and the report from the chairman of the committee in charge will, no doubt, cover all the details.

General.

"Our other programs have been open to criticism because of the fact that too many papers were presented and too little time given to discussion. We have agreed that the number of papers to be read should be held to a minimum, thus giving all of the members an opportunity to discuss them. The interchange of ideas brought about by such discussion cannot help but be of educational benefit to us all. We hope that everyone will take a personal interest in whatever questions may be brought before the convention.

"In thanking those members who have put forth their energies to make this convention a success by presenting papers on subjects of practical interest, I must say that we are fortunate, indeed, in having selected men who are especially well-fitted for this work. I wish also to express my appreciation of the work done by the various committees, and to thank those members who have assisted in the work of the association during the year. I hope that this meeting will be a source of great benefit and pleasure to all."

Technical Sessions.

The following papers which were read and discussed at the technical sessions on Tuesday and Wednesday will be published in full in early issues of this journal, together with the chief points brought out in the discussions: **"Oil Gas,"** by Leon B. Jones, **"Industrial Uses of Gas,"** by John B. Redd; **"Rate Making,"** by Dr. A. C. Humphreys, **"Modern Gas Distribution and the Part Played by the Automobile,"** by D. E. Kepplemann; **"Why the Gas Company Should Handle Gas Arc Lamps,"** by C. B. Babcock; **"Gas Company's Public Policy,"** by L. A. Wright; **"Standard of Quality and Service for Oil Gas,"** by H. Papst; **"Wrinkles,"** by H. W. Burkhart; **"Experiences,"** by John Clements; **"Novelties,"** by H. P. Pitts.

At the regular business meeting Long Beach was chosen as the next meeting place. The following officers were elected: President, C. S. Vance, Los Angeles; vice-president, E. C. Jones, San Francisco; secretary-treasurer, Henry Bostwick, San Francisco. Directors—John A. Britton, San Francisco; William G. Kirckhoff, Los Angeles; William Bourhyte, Los Angeles; F. A. Green, Long Beach; C. B. Babcock, San Francisco.

Entertainment.

The annual banquet was held in the Hotel Vendome on Wednesday evening and on the following morning the delegates were the guests of the Pacific Gas & Electric Company on a trolley ride around the loop on the Peninsular Railroad. The party, leaving San Jose at 10 o'clock, proceeded to Saratoga and Los Gatos, returning to San Jose by way of Campbell. From there they went through the orchards of Berryessa to the famous Alum Rock Park where luncheon was served. In the afternoon dancing and other amusements were indulged in until 5 o'clock when the party returned to San Jose.

PANAMA-PACIFIC INTERNATIONAL EXPOSITION.

The Exposition Company has closed the gates to free public admission and is charging the nominal sum of 25c for adults, 10c for children and 50c for automobiles. Work is progressing rapidly and seems certain that all of the exhibit palaces will be completed nine months before the opening date. At present 25,100 ft. of high pressure water pipe has been laid, about 40 per cent of the total; 80 per cent of the work on the Machinery Palace has been completed, 1,070,000 ft. of lumber being erected during the month of August. About 40,000 ft. of the finished roofing has been completed. All lumber for the Palace of Education has been received, and since August first, 375,000 ft. have been placed in position. Nearly all the structural work for the Food Products Building has been framed. The conduit system for the Exposition Building section is nearly half completed. Nearly 2,000,000 ft. of lumber has been placed below the first floor in the construction of the Agricultural Palace. The first floor work on the Manufacturers' Building has been completed and the framing of columns and trusses is going forward rapidly.

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POWER AND GAS

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Electrical Lumbering

Pacific Coast electrical engineers are giving much attention to the application of electric power to the lumber industry. As has been noted from time to time in these columns it has been successfully applied to sawing, planing and haulage, and as may be noted elsewhere it has now been adapted to logging. E. J. Barry's paper on "Logging by Electricity" brought out a most interesting discussion at Vancouver and next week this subject will occupy the center of the stage in the Logging Congress at Spokane, Wash.

Little argument is now needed to convince the average millman that electric drive in the sawmill is the ideal form of power, but the question as to whether this power should be generated by the mill or purchased from a central station is still open for discussion. One side of this question was recently discussed in these columns in favor of the former procedure. Even where the costs are about equal the laws of most of the Western States forbid that the refuse be dumped into streams or left standing on the ground. Unless it is burned to make steam some method must be devised for its utilization. Several unsuccessful attempts have been made to convert it into wood alcohol, considerable money having been expended in one plant at Port Havelock which has now been abandoned. At Tacoma the sawdust and "hogged" wood is used to make briquets, though the demand at present is somewhat limited. At Vancouver, B. C., extensive experiments are being conducted on the distillation of turpentine, an electric furnace being used to insure absolute control of the temperature. The U. S. Forest Service also are working towards the conservation of this waste. As a matter of fact, this is a subject of vital concern to central stations for by making this by-product of value it will no longer be economical to use it as fuel.

As regards electric logging, the great money saving quoted by Mr. Barry is only one item in favor of its adoption. Of far greater importance is its elimination of the fire risk. This year one mill in the Pacific Northwest shut down early in June because afraid of fire and thus lost the best part of the year. It is quite likely that in time the state and national governments will forbid the use of donkey engines for logging where electric power is available.

From a central station standpoint a single logging equipment is not desirable because of its low load factor, but where two or three outfits can be put on a line the initial cost is reduced in proportion. Tests have shown that it requires about 10 kw.-hours to bring in a thousand board ft. of lumber. When it is considered that there are now over two thousand donkey engines in the State of Washington alone, that one-half of Oregon's industrial population is employed in this lumbering and that these two States contain one-third of the standing timber in the United States, it may be realized that the central station and electrical manufacturer is vitally interested in the application of electricity to this great industry.

Mountain Railway Electrification

From a financial viewpoint perhaps the most important of the several excellent papers presented at the Pacific Coast convention of the American Institute of Electrical Engineers at Vancouver, B. C., last week was that wherein A. H. Babcock so forcefully demonstrated that electrification of the Southern Pacific Company's lines over the Sierra Nevada Mountains was not commercially feasible under existing conditions. This conclusion has been reached only after several independent investigations which were initiated with what might almost be called a favorable prejudice, if such a feeling can ever be ascribed to an engineer. As may be noted elsewhere in these columns, the paper and appendices present a careful analysis of the costs of electric construction and operation as compared to those of steam operation, the former showing a net loss, whether power is generated by the railway company or purchased from a central station.

At first reading this paper is distinctly disappointing, especially to those who may have apparatus or current to sell. But when it is considered that the figures would not be materially changed if the power cost nothing and furthermore that the exacting requirements of this particular installation are not comparable to other great projects, it forms a fitting inspiration in showing how the problem should be attacked.

That is costs three times as much to convert a mountain railway from steam to electric motive power as to electrify an interurban road is due not so much to the high cost of electrification as to the high fixed charges of steam railway construction. The great overload capacity of the electric motor enables it to negotiate grades which could not be approached by steam locomotives. As a result, fewer tunnels are necessary, less grade and fill, and fewer curves. The saving in the initial cost of an electric as compared to a steam right-of-way would more than pay for the cost of electrification.

Finally direct financial profit from the initial investment is not the only factor to be taken into account. In the matter of safety and convenience, low operating and maintenance charges, and other advantages, as pointed out by the author, "the profits from electrification must be realized indirectly rather than directly."

The Importance of the Load Factor

Mining, lumbering and railroading are the three great industries in the West, aside from agriculture, to which electric power must be applied. Yet when owners object to the rate which they are asked to pay for electric power they cannot understand that it is largely due to the low load factor which characterize each of these industries. A brief explanation of the term may aid in an understanding of its effect.

"Load factor" is a ratio, usually expressed as a percentage. Ordinarily this ratio is that of the average demand for power during a given period to the maximum demand during the same period. It is frequently applied to a twenty-four-hour period, though there is no reason why it should be so limited. With many Western companies the annual load factor is as perplexing as the daily load factor. The greater amount of electric lighting in the winter months seldom compensates for the decreased load of irrigation pumping which operate during the summer, whereas the Eastern manager usually figures on a winter peak. Considering the daily load factor, electric logging or mountain electric railways have a load factor of only about twenty per cent.

A low load factor means that sufficient apparatus must be installed to care for the maximum demand. This necessitates duplicate units and large generating capacity which is idle during periods of average and minimum demand. Unlike water or gas, alternating current cannot be stored, but must be manufactured for instant use at a moment's notice. While a storage battery can be installed to increase the efficiency of a direct current plant by improving its load factor it is necessarily expensive and increases the cost per kilowatt-hour as compared to a plant with a good load factor.

The transmission and distributing system, also, must be designed to care for the maximum amount of power which it will be called upon to deliver. With a low load factor a large investment is thus frequently idle for a large part of the time. This is one of the main reasons why many central stations have not been more energetic in introducing electric ranges, as a large investment in copper and in transformers must first be made.

From the foregoing it is seen that the cost of generating and distributing a given amount of electric power is largely dependent upon the load factor. Consequently the cost to the consumer may vary within wide limits due to the fixed charges required to properly equip a plant for its peak load.

International Engineering Congress

A detailed announcement of the plan for the International Engineering Congress at San Francisco in 1915 has been made by the Committee of Management as a result of numerous suggestions and conferences. In order that the congress may be self-supporting to some extent it is proposed to publish the transactions in the form of ten or more large volumes, each dealing with some one of the several main branches of engineering with which the congress is to be concerned and constituting a comprehensive survey of the present state of the art.

Membership in the congress may be obtained upon payment of a nominal fee, which also entitles the subscriber to any single volume which he may desire, together with the privilege of securing additional volumes at a sliding scale of prices to be determined later. This project is worthy of the financial and moral support of every engineer in the West and as such is heartily commended to our readers.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Edward L. Moreland has been appointed manager of the Boston office of D. C. and Wm. B. Jackson.

J. O. Case, of the General Electric Company, Los Angeles, spent a few days during the week in San Francisco.

O. A. Schlesinger, manager United States Light & Heating Company, San Francisco, returned Thursday evening from a business trip to Los Angeles.

R. L. Douglas, commercial department, San Joaquin Light & Power Company, Fresno, Cal., was at San Francisco this week.

R. H. Henderson, formerly Manager of Works of the Westinghouse Lamp Company, Bloomfield, N. J., has resigned his position to engage in other work.

G. I. Kinney, manager San Francisco branch Fort Wayne Electric Works, has gone south for a few days. He attended the Pacific Coast Gas Association convention at San Jose this week.

W. F. Neiman, sales manager of the Great Western Power Company, who has been confined to his home recently from a mild attack of appendicitis was at his office again during the week.

Mr. Blosser, at one time salesman for the Holophane Works of the General Electric Company, and the Fostoria Glassware Company, on the Pacific Coast, has accepted a position with the H. W. Johns-Manville Company, in the illumination engineering and sales department, at Milwaukee.

D. R. Wedgewood, formerly salesman for the Crocker-Wheeler Company has become connected with the electrical department of Fairbanks, Morse & Company's San Francisco office. Mr. Wedgewood was at one time employed by the Great Western Power Company and is well fitted for his new position.

Glenn Marston, Associate Editor of "Public Service," was a Salt Lake visitor last week. He is on his way East from an investigation of public utility conditions on the Pacific coast. He made a thorough examination of the system of the Utah Light and Railway Company and reports that conditions there compare favorably with those existing in other parts of the West.

H. S. Black has been appointed Manager of Works of the Westinghouse Lamp Company, Bloomfield, N. J., to succeed **R. H. Henderson,** resigned. Mr. Black has had considerable experience in the engineering and manufacturing department of the National Quality Lamp Division of the General Electric Company. For the last three years he has been directing the work of the St. Louis factory of this company, in which he has been unusually successful.

T. E. Barlow and wife, **T. E. Berger, T. E. Bibbins, H. V. Carter, A. H. Elliott, S. P. Gregory, Brewster Hall** and wife, **C. B. Hall, C. C. Hillis, R. B. Holabird, F. H. Murray, A. H. Neylan** and wife, **F. H. Poss, H. E Sanderson, C. E. Wiggin,** and **Garnett Young** left Tuesday evening in a special car on the Southern Pacific to attend the Pacific Coast Jobbers' Convention at Gearhart Park, Oregon. **A. H. Halloran** and wife, returning from the Pacific Coast Convention of the American Institute of Electrical Engineers at Vancouver, B. C., joined the party at Portland.

H. W. Reynolds has been appointed by the United State government to a professorship of mechanical engineering in the University of the Philippines and will sail from San Francisco the early part of next month. Mr. Reynolds was graduated from the University of Pennsylvania in 1899 and was associate professor of mechanical engineering at the University of California for eight years. The University of the Philippines already has an excellent department in civil engineering, and Mr. Reynolds will start the new department to meet the growing demands for such work. He was employed by the Imperial Chinese government two years ago and realizes the possibilities existing in the Far East. He has been connected with the San Francisco office of Chas. C. Moore & Company for the past year, and during his connection here and at the University of California has made many friends who will wish him success in his new work.

MEETING NOTICES.

Electrical Development and Jovian League of San Francisco.

The regular monthly business meeting was held Tuesday of this week. The minutes of the previous meeting and the treasurer's report were adopted and reports of the various standing committees were heard and placed on file.

Announcement was made by the entertainment committee of the acceptance by Mayor Rolfe of San Francisco to address the league at the meeting of September 30th.

A committee was appointed to co-operate in an effort to have various local, national and international electrical and engineering organizations, who contemplate holding their 1915 meetings in San Francisco, and who may not have yet selected their dates of meeting, join in the idea of having all such meetings held at one particular time or season of the year.

Los Angeles Jovian League.

The Jovian Electrical League of Southern California meets every Wednesday at 12:15 p. m. at Christophers, 551 South Broadway (upstairs). There will be an interesting speaker at each meeting. In the future weekly postals will not be sent out, so get the habit now and attend regularly.

Salt Lake Jovian League.

The outing of the Sons of Jove and the Utah Electric Club at Lagoon on the 6th inst, was a complete success, both from the standpoint of enjoyment and attendance. One of the features of the afternoon was a baseball game which was indulged in by a number of members who did not have a very recent acquaintance with the little leather sphere. Three-legged races, sack races, potato races, ladies' races, etc., occupied the afternoon and early evening, when a most enjoyable chicken dinner was served by the Lagoon management.

Great preparations are being made by Statesman Brandenburger for the rejuvenation which will occur on October 4th. It has been found advisable to change the date from that at first contemplated to this latter date. It is expected that a large class will be introduced into the mysteries of Jovianism.

ELECTRIC RAILWAY EMPLOYEES' CONVENTION.

The Biennial Convention of the Amalgamated Association of Street and Electric Railway Employes of America was in session in Salt Lake during the past week. Mayor Samuel C. Park delivered an address of welcome to the convention Monday morning at 10 o'clock, which was responded to by W. B. Mahon, president of the association.

C. O. Pratt, who was the business agent of the Philadelphia local No. 477 which was suspended from the association for insubordination at the convention of St. Joseph, Missouri, two years ago, is in attendance at the convention, and is making every effort to have the Philadelphia union reinstated. To date no definite action has been taken. Mr. Pratt rented the Salt Lake Theater and in an impassioned address made an appeal for his fellow workers, which was favorably received by the large audience in attendance.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The Railroad Commission rendered a decision directing the San Jose Railways to reconstruct as a standard gauge line its narrow guage system from San Jose to Toyon Station, a distance of 4½ miles. The company was also directed to make connection at Toyon Station with the Peninsular Railway.

Ansel M. Easton was granted authority to sell the Black Hawk Water Company to the city of Burlingame for $5520.

The Western States Gas & Electric Company was granted authority to issue $354,000 of bonds for the purpose of refunding existing indebtedness.

A decision was rendered granting authority to Arthur W. Sloan and Frank Rosebrough to sell their water system in Nordhoff to the Ojai Power Company for $3000. The Ojai Power Company was authorized to operate a water system, to lease a water system from the Ojai Improvement Company, and to issue $10,000 of stock.

J. R. Anderson was granted a certificate of public convenience and necessity to operate a gas plant in Oakdale.

The Humboldt Transit Company was granted authority to execute a note in the sum of $20,000 to refund indebtedness.

A decision was rendered granting authority to the Southern Counties Gas Company to issue $6500 of bonds.

The commission dismissed the order of Fraser and M. Sallee against the Southwestern Home Telephone Company and the Pacific Telephone & Telegraph Company. The rates complained of had been remedied to the satisfaction of the complainant. The complaints of John W. Reese and J. A. Hoag were dismissed for the same reasons.

The Amador Electric Light & Power Company has applied for authority to sell $12,000 bonds and issue $3000 in stock. The proceeds from the sale of the bonds are to be used in paying existing indebtedness and making additions to the company's system. It is proposed to issue the stock to the estate of Mary A. Beacon as a stock dividend alleged to be due.

EDUCATING THE PUBLIC IN THE USE OF LIGHT.

Within the past month, the Illuminating Engineering Society has printed for several large lighting and manufacturing companies throughout the country, an edition of more than a quarter of a million copies of its illumination primer, "Light: Its Use and Misuse." It is being widely circulated by these companies for the purpose of creating an appreciation and demand for more and better light.

The recent edition of the primer, which contains a few minor changes in the original one, was published in a very inexpensive form so that it might be circulated at small cost. For the companies which are going to issue this pamphlet to their customers during the coming lighting season, the society in arranging to publish two new large editions, which will be available at prices that merely cover the publication costs involved. Sample copies may be obtained by interested companies upon application to the general offices of the society, 29 West Thirty-ninth street, New York.

TRADE NOTES.

Chas. C. Moore & Company, Seattle, have installed a condenser and some additional piping for the Alaska-Treadwell mine in Alaska.

The Robert Electric Works obtained the electrical contract for the wiring of the Modern Candy Factory's new building in Portland.

The Pacific Fire Extinguisher Company obtained the electrical contract for the wiring made necessary by the reconstruction of the Hamilton Building, Portland.

The Canadian Rand Company, through R. A. Williams, special Vancouver representative, has secured the central power plants, air compressors and equipment for construction of the double bore tunnel of the Canadian Pacific in the Northwest.

The Mechanical Installation Company, San Francisco, is installing a new crane and changing some of the wiring for the C. A. Smith Lumber Company at Bay Point, Cal. This is one of the most completely equipped electrical lumber plants in California.

Barr & Anderson, heating and plumbing contractors, Vancouver, B. C., have secured a $300,000 contract with the Hudson's Bay Company, for furnishing plumbing, heating, lighting, wiring and mechanical electrical equipment for the new Hudson Bay store at Vancouver.

The West Coast Engineering Company of Portland, Oregon, has completed the installation of power and lighting apparatus in the mills of the Hawley Pulp & Power Company of Oregon City. This work consists of generating equipment of 250 kw. capacity, motors for driving paper making machinery, and the complete overhauling of the lighting of the plant, and the wiring of a new concrete mill. The company has also installed an electric log unloader for the Silver Falls Timber Company, is overhauling the lighting system on the U. S. Government dredge Cletsop, and has the contract for complete electrical equipments of the new government dredges Multnomah and Waukiskum, being built at Portland.

The Pacific Electric Manufacturing Company, is engaged in shipping the following orders: Six 60 kilovolt poletop switches to the Pacific Power & Light Company, Portland; one hundred 3-pole 22 kilovolt poletop switches to the Southern California Edison Company, Los Angeles; two 66 kilovolt poletop switches to the Washington Water Power Company, Spokane; one 110 kilovolt and five 33 kilovolt oil switches to the Sierra & San Francisco Power Company, San Francisco; two 33 kilovolt oil switches to the Coast Counties Gas & Electric Company, Santa Cruz and five 45 kilovolt poletop switches to the Washington-Oregon Corporation, Portland.

BOOK REVIEWS.

Electric Wiring and Lighting. By Charles E. Knox, E. E., and Geo. E. Shaad, E. E. Size 5¾x6½ inches; 94 pages; 90 illustrations; cloth binding. Published by American School of Correspondence, Chicago, Ill., and for sale by Technical Publishing Company, Rialto Bldg., San Francisco, Cal. Price $1.00.

This book has been written especially for self-instruction and home study. It will probably be found useful as a handbook. The numerous illustrations showing methods of wiring and the frequent references to the National Electrical Code, make this book especially valuable to the young electrical contractor.

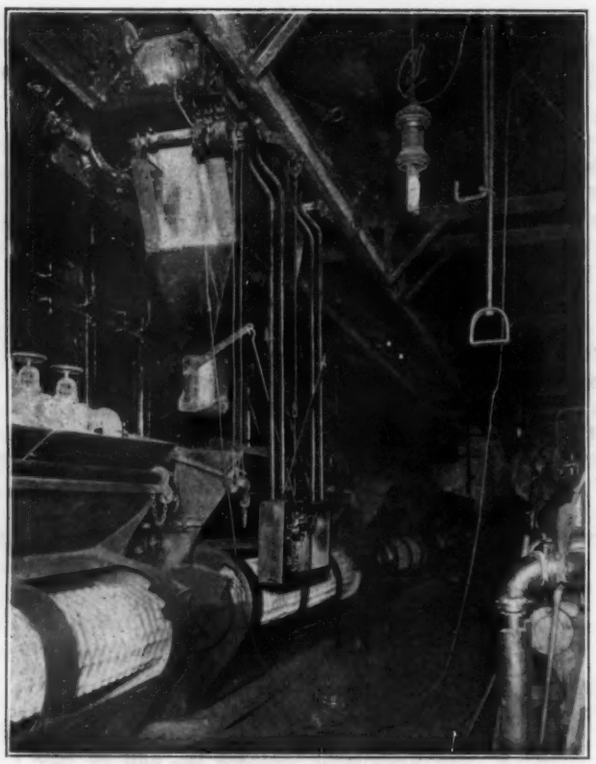
Walker's Manual of California Securities and Directory of Directors. By H. D. Walker, 454 Montgomery street, San Francisco; 525 pp.; 6x9. For sale by author and Technical Book Shop, San Francisco. Price $4.00.

The mere fact that this work now appears for the fifth year bespeaks its value. This fifth annual number has been enlarged and gives information regarding many companies not mentioned in previous issues, with additional information concerning those previously presented. The nine sections treat of state and municipal securities, banks, power, sugar and oil corporations, San Francisco street railway franchises, stock and bond quotations, and directory of directors. As a financial reference there is no other manual published which contains more detailed and complete information concerning local companies.

INDUSTRIAL

BOILER ROOM SCALE.

A suspension boiler room scale with special type registering beam, motor driven, has been recently installed by Fairbanks-Morse & Company, for the Puget Sound Traction, Light & Power Company, at their Post street station in Seattle. The scale was installed to secure a quick and accurate weight of all coal going into the seven automatic stokers. The car on which the scale and hopper is suspended is driven by a Fairbanks-Morse 2 h.p., 230 volts, direct current, series wound enclosed type motor, operated by a reversible crane type controller having five speeds forward and reverse.



Suspended Boiler Room Scale.

The weighing operation is simple. The type registering ticket, which is ⅝ in. wide and 14 in. long, is placed in the small metal tube just beneath the beam and the poise is set at the desired weight, in this case being 2100 pounds, the capacity of the hopper. The coal is then released from the bunkers above into the scale hopper until the beam balances. The small hand lever at the bottom of the poise is then pulled forward, stamping the correct weight on the ticket. When the hand lever is released the ticket moves forward one space ready for receiving the next impression. The operator then grasps the controller rope with one hand and the hopper gate lever with the other and distributes the coal evenly in the hopper above the stokers. The type registering ticket has space for 75 separate weighings, which is the maximum for an eight hour shift. At the end of each shift this ticket is removed and the weight totaled up, thus securing an undisputable record of the actual amount of the coal consumed. The scale can be easily run from one end of the building to the other in less than a minute, thus enabling the operator to feed the seven boilers without difficulty.

EDISON STORAGE BATTERIES AT THE CALIFORNIA STATE FAIR.

Perhaps one of the most interesting and instructive exhibits at the California State Fair is that of the Edison Storage Battery Supply Company. The booth itself is lighted by current furnished from Edison batteries, while a practical demonstration of a complete isolated house-lighting plant is made, affording visitors opportunity of seeing for themselves the advantages to which the batteries may be placed for lighting in the home and on the farm. Other uses to which the batteries may be placed and which will also be in practical operation, are railway signals and commercial electric trucks. The truck used in the exhibit is also a California product, being made by the Holt Brothers Company of Stockton, equipped with Edison batteries, and is intended for delivery purposes in Portland, where it will be shipped at the close of the fair.

The absence of lead and acid in the manufacture of these batteries has eliminated many of the disagreeable features of the old-style makes and has gone a long way in meeting the demand for a strong, compact and easily handled electric storage battery.

"EXIDE" STORAGE BATTERIES ON LOG RAFT.

In accordance with government regulations on the Columbia River, the log rafts—unquestionably the largest in the world—can only be towed down the river at night on account of the interference with navigation in the day time. For the purpose of safety these rafts must be equipped with lights at both the head and end of the rafts, a storage battery and lamp being suspended from poles set up on the raft. The electric light is placed directly over a case containing the batteries this doing away with practically all wiring. The lamp is equipped with two 4 candle power lamps wired in parallel and the battery consists of two 6 volt "Exide" batteries having a capacity of 100 ampere hours.

This electric raft light was designd by the Astoria Hardware Company, of Astoria, Oregon, and the batteries were furnished by the Electric Storage Battery Company of Philadelphia. This arrangement keeps the batteries at a considerable height above the raft, where there is no danger of their being washed over by heavy seas. This scheme has been used for sometime and has given perfect service.

NEW CATALOGUES.

Sanitary Dustproof Lighting Unit for Hospitals is the title of a leaflet recently issued by the Lighting Studios Company, New York.

The Pittsburg High Voltage Insulator Company, Derry Penn., have issued catalogue No. 3, which besides showing plans and specifications for insulators and accessories of standard and approved designs, gives a brief illustrated description of their factory and methods of designing, making and testing insulators.

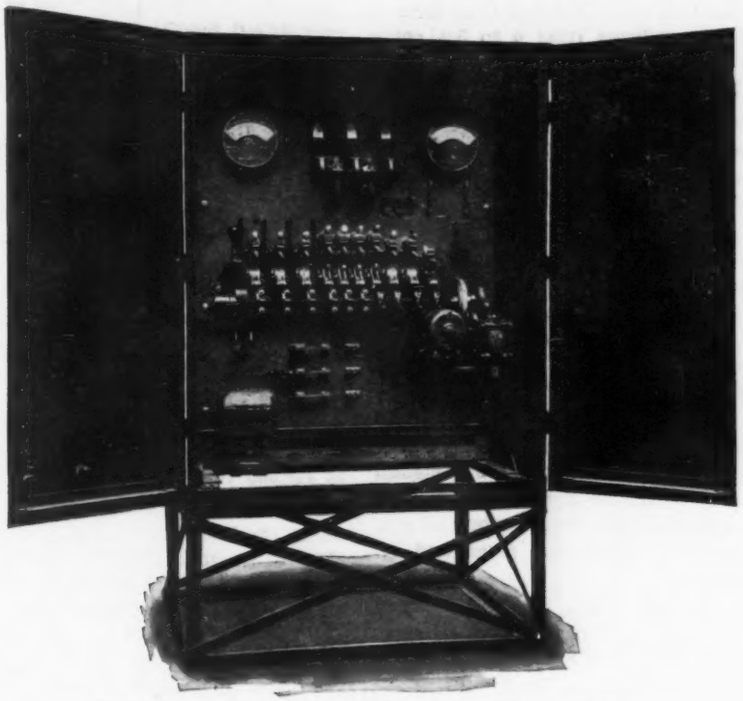
Folder 4187, issued by the Westinghouse Electric and Manufacturing Company, covers the type KB Section Insulator. The iron parts of this device are sherardized, and wearing parts are renewable. It is said to be an unusually strong and light-weight insulator.

Leaflet No. 3569 issued by the Westinghouse Electric and Manufacturing Company, describes and illustrates the shipment of transformers in tanks with oil. This method has become very prevalent in the shipment of large transformers, enabling them to be installed immediately upon arrival at destination.

COMBINED AUTOMATIC AND MANUAL CONTROLLERS FOR ALTERNATING CURRENT FIRE PUMP MOTORS.

The controller for a fire pump motor must be simple in design, easy to operate and reliable. The Cutler-Hammer Manufacturing Company, of Milwaukee, have recently put a new type motor-driven fire pump controller on the market. The one shown in the illustration is for a 100-h.p, 440-volt, 3-phase,60 cycles, slip-ring motor. Mounted on the control panel are a voltmeter, an ammeter, a three-pole rigid arm plain overload circuit breaker, a three-pole. double-throw knife switch, a pressure governor and a combined manual and automatic fire pump motor starter. At the back of the panel in a suitable angle iron frame are mounted the cast iron resistance grids, which are used as a starting resistance in the secondary circuit of the motor. The whole controller is enclosed in a sheet iron splash-proof case, mounted on a pedestal two feet high.

The double-throw knife switch is for transferring the motor from one set of service lines to another, as connection



New Cutler-Hammer A.C. Fire Pump Motor Starter.

to two separate power lines is often provided for reliability. The starter proper consists of a square shaft above which are mounted the three primary and the six secondary cam operated switches. There is also an auxiliary cam operated switch at the extreme right, the function of which is described below. The cam shaft, which actuates these switches, is revolved for manual operation by a hand lever shown at the extreme left of the shaft.

The manual operation is of primal importance, and it is only necessary for the operator (who may be an inexperienced night watchman) to pull the hand lever from the upper position through 180 degrees to the lower or full running position. The lever is held in the running position by an automatic release coil. The movement of the lever above described first closes the three primary switches simultaneously, and then closes the secondary resistance switches in proper succession, until the motor is brought up to full speed. The secondary switches are so designed that the resistance is cut out of each phase at the same time in equal portions and thus the motor is kept balanced all during the starting period. On failure of voltage or at the will of the operator the switches are all opened, the shaft being returned by a heavy clock spring.

If automatic control can be conveniently incorporated without complication of the hand operation, it gives a satisfactory method for maintaining a constant water pressure when a single sprinkler head opens or when a leak develops in the piping system. Futhermore, the automatic operation provides a safety feature which is not available in a straight hand starter.

As in the hand operation the cam shaft is revolved to start the motor, but the operation in this case is taken care of automatically by a pilot motor mounted on a bracket below the right hand portion of the shaft. This motor drives the shaft through a worm-gear reduction box, the gears running in oil. A solenoid operated clutch is between the reduction gear box and the cam shaft. The automatic starting operation is as follows: When the pressure in the tank or stand pipe falls below a predetermined amount, due to opening of sprinkler heads, leaks, etc., the pressure governor closes the control circuit for a small two-pole magnetic switch located just above the cam shaft at the right hand end. This switch closes and opens the pilot motor circuit. At the same time the governor closes the clutch solenoid circuit. The pilot motor revolves and a spring behind the movable jaw clutch member is compressed by the clutch solenoid. As soon as the jaws match, the spring causes the clutch to engage and the cam shaft is revolved. The three primary switches are closed quickly, due to the shape of their cams. The secondary switches are then closed in succession, cutting resistance out of the motor rotor circuit just as in the case of hand operation. After the last secondary switch is closed the auxiliary cam switch opens and drops out the pilot motor switch, thus stopping the pilot motor and preventing further revolution of the cam shaft. The worm gear reduction prevents the motor revolving backwards, and keeps the switches in the running position with the fire pump motor up to speed.

The clutch solenoid remains in until the pressure in the sprinkler system reaches the required maximum, when the pressure governor opens the circuit to the clutch solenoid, disengaging the clutch. The heavy clock spring returns the cam shaft quickly to the "off" position. The clutch solenoid is therefore the automatic and no-voltage release, because the solenoid when de-energized allows the starter to return to the off position, stopping the motor.

NEWS NOTES

ILLUMINATION.

FOWLER, CAL.—The trustees have granted A. A. Webber of Los Angeles a permit to install a gas plant here.

ARROYO GRANDE, CAL.—Mr. Fessler, local foreman of the Santa Maria Gas Company, has measured off the most direct route for a pipe line between here and San Luis Obispo, it being the intention of the company to carry the line on to the county seat.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has applied to the railroad commission asking approval of a contract under which it will furnish electricity to the Oro Electric Corporation in variable quantities at prices ranging from 6c to 7c per kw. hour.

SEATTLE, WASH.—A council bill has been introduced by the city utilities committee by which lighting rates for residences and churches will be reduced from 6 to 5½ cents per kw.-hr. for service up to 60 kw.-hr. per month, and to 4 cents for all service of more than that amount.

WINTERS, CAL.—Sealed bids will be received by the clerk of the board of trustees, up to October 7th for the sale of a franchise to use the public streets and alleys of the town of Winters, for the laying of pipes and conduits, for supplying the inhabitants of this town, with a gas lighting system.

PORTLAND, ORE.—Bids will be received by H. R. Albee, commissioner of public safety, until September 24, for the complete installation of electric lighting fixtures for the new city jail on Second and Oak streets. Plans and specifications are on file in the office of the architects, Emil Schacht & Son.

HERMOSA BEACH, CAL.—An ordinance has been adopted by the board of trustees, ordering that ornamental lighting posts, with all appliances, be erected along Thirteenth and Fourteenth streets, also that fibre conduit be constructed therein, according to specifications, plans and requirements of this resolution.

REDLANDS, CAL.—A resolution has been adopted by the Board of Trustees, ordering that 37 cast iron ornamental lighting posts be erected along Central avenue, Fifth, Vine and Fourth streets. All posts are to be equipped with necessary wires, lamps and all other appliances, in accordance with special plans and resolution requirements.

SEATTLE, WASH.—The budget committee of the Seattle city council in considering appropriations for next year, discussed an item of $5000 for the employment of a gas expert to appraise the property of the Seattle Lighting Company and to give testimony as to the amounts to be allowed for overhead charges when the state public service commission holds its hearing on the complaint of the city council that the rates of the company need adjustment. The committee has requested the public utilities committee to ascertain just what amount it would be necessary to pay for the services of an expert.

GRAND JUNCTION, COLO.—A Washington dispatch conveys information that Grand Junction has been granted a preliminary permit for a conduit on the Battlement National Forest. The city proposes to install a municipal hydroelectric plant for the development of light and power. The Grand Junction Electric, Gas & Manufacturing Company, which now furnishes power to the city and the surrounding country, is trying to sell its entire holdings to the city. As this development bears on the federal policy of co-operation with states, counties and municipalities for the common welfare, government officials at Washington express particular interest in it.

TRANSMISSION.

SALEM, ORE.—Surveys have been completed by State Engineer Lewis for a large power project on the Klamath River. According to estimates made, about 100,000 horsepower can be developed by building a canal and tunnel 10.5 miles long. An important problem is the disposition of such power after it is developed.

VANCOUVER ISLAND, B. C.—The Canadian Collieries Company has recently started operating its new $1,500,000, 16,000 horsepower plant on the Puntlidge Lake development. Grant, Smith & Company were general contractors, the electrical equipment was furnished by the Canadian General Electric Company and Escher Wyss Company of Zurich, Switzerland, furnished the waterwheels.

WASHINGTON, D. C.—On September 5th the secretary of agriculture signed a water power permit granting to the Sierra Electric Power Company the right to use for power development certain land within the Lassen national forest, California. The company is organized under the laws of the state of California and has its office and place of business in Oakland. The waterpower project is located on Mill Creek and approximately 25 miles east of the city of Red Bluff in Tehama county. By means of low dams across the creek the flow is to be diverted into a conduit with a capacity of 300 second-feet and a total length of more than 16 miles. At the upper end of the pressure pipes a small regulating reservoir is to be built. By this means, it is hoped to reduce, if not eliminate, a large portion of the water-waste occasioned by hourly fluctuations of the load. In the power house—which is to be built of concrete—there will be installed machinery capable of providing a constant output of 22,500 kilowatts. The electric power will be transmitted to the market at 110,000 volts.

SAN FRANCISCO, CAL.—In accordance with notice given on July 26th the stockholders of the Pacific Gas & Electric Co. met last week and authorized the issuance of a 1-year 6-per-cent note issue of the maximum amount of $7,000,000. This is the note issue which was authorized by the railroad commission on August 11th. The sale of $4,500,000 of this issue to a syndicate of New York bankers has been announced heretofore. The unsold remainder of $2,500,000 will be held in reserve and will not be sold unless it is found necessary. These notes will be secured by $5,000,000 par value, general and refunding 5-per-cent bonds, and $5,000,000 general lien 6-per-cent bonds of the company, both of which issues have already been authorized by the railroad commission. When conditions in the money market become normal these bonds will be sold, and will not only provide sufficient funds for redeeming the notes, but will leave a substantial balance of cash to the company for future improvements. The funds derived from the sale of the $4,500,000 notes are being used by the company in the prosecution of its Lake Spaulding development and for other extensions demanded by the growth of its business.

TRANSPORTATION.

GREAT FALLS, MONT.—A project is on hand to construct a trolley line five and one-half miles from Red Lodge to Washoe. Surveys and estimates by County Engineer Gibson fix the cost of such a line at $50,000.

ALBANY, CAL.—The town of Albany has filed a suit for $5000 damages against the Oakland Traction Company, alleging that the company has failed to comply with the agreement in the franchise to extend and operate lines through Albany.

LOS ANGELES, CAL.—The city council has authorized the city attorney to prepare notice for sale of a franchise applied for by Pacific Electric Company for railway on Maubert avenue, from Sunset and Hollywood boulevards, to Los Feliz road. The franchise is recommended by the public utilities commission.

SAN FRANCISCO, CAL.—The San Francisco & Oakland Terminal Railways Company has applied for an injunction in the United District Court to prohibit the Alameda city council from enforcing its ordinance requiring the corporation to carry school children for half fare only. The corporation alleges that enforcement will impair its franchise, and that it cannot afford to transport children at this rate. A permanent injunction is prayed for, and an order declaring the ordinance illegal.

SAN FRANCISCO, CAL.—The supervisors have passed to print the ordinance providing for the issuance of $3,500,000 of 5-per-cent bonds to provide for the extension of the municipal railway system on Van Ness and Potrero avenues, Stockton, Eleventh, Church, California and other streets. Two accompanying resolutions were adopted, one formally declaring the result of the late bond election, the other requesting the city attorney to solicit offers from the Presidio & Ferries Railway Company for the sale of such of its property to the city as may be useful in the carrying out of the proposed extension plans.

TELEPHONE AND TELEGRAPH.

HAYWARD, CAL.—The city trustees have awarded the contract for the installation of a fire alarm system to the Gamewell Fire Alarm Company for $3985.

PASADENA, CAL.—The Home Telephone Company is planning a new trunk line between South Pasadena and Los Angeles. Two carloads of cable have been received for the line.

MORGAN HILL, CAL.—The trustees have passed an ordinance granting to T. H. Dassel, a franchise to construct and operate a telephone and telegraph service in the town of Morgan Hill, for a period of 50 years.

SAN FRANCISCO, CAL.—At the suggestion of the electricity committee of the supervisors, the board of works and the city engineer's department will consult with the chief of the department of electricity, Wm. J. Nixon, in the preparation of plans for the new fire alarm and police signal station which is to be built in Jefferson Square.

CHANDLER, ARIZ.—W. Clyde Palmer, district sales manager of the Mountain State Telephone & Telegraph Company, states that construction of lines in the Chandler district will start soon preparatory to installing an exchange here. Work is to be completed within 60 days. The lines will extend for a distance of four miles around Chandler and take in all ranches within that radius.

SAN FRANCISCO, CAL.—At the hearing last week before the railroad commission, sitting en banc on the question of telephone toll rates, G. E. McFarland, president of the Pacific Telephone & Telegraph Company, testified that the re-production cost of the company's property within the State of California was approximately $51,000,000, and that the present value of its holdings was probably 85 per cent of that amount. He maintained that, should the commission's proposed rates go into effect, the company would earn only 2.23 per cent on a valuation of $51,000,000, or about $1,250,000, within the state. These figures, he stated, made no provision for the interest charges on the $32,000,000 of 5 per cent bonds outstanding. McFarland testified, relative to the question as to what portion of the extensions had been built out of earnings, that the depreciation reserve of the company on June 30, 1913, was $9,012,999, and of this amount $5,952,416 had been allotted to California, and was now invested in the assets of the company. He further testified that $4,000,000 would be expended on construction work in this state during the present year.

WATERWORKS.

TULARE, CAL.—The firm of Sloan & Robson, engineers, who have charge of the work of installing the new municipal water system have begun work on the distributing system.

HILLYARD, WASH.—The city council of Hillyard passed an ordinance to install four and six inch metal lateral water mains throughout the city at an estimated cost of $91,740.

REDLANDS, CAL.—J. H. Flynn, representing the Southwestern Home Telephone Company, is laying out a telephone system for Yucaipa valley, with a switchboard in the Yucaipa hotel.

MANTECA, CAL.—A Bacilieri is superintending the extension of his water system. Five thousand dollars will be spent in improvements, a pump of larger capacity will be installed and a larger tank built.

SACRAMENTO, CAL.—The city of Sacramento has awarded to C. F. Braun & Company, the contract for a 15,000,000 gallon per day Alberger centrifugal pumping engine unit, the steam turbine and centrifugal pump, replacing a smaller unit of the obsolete reciprocating type. The city will, with this modern unit, be able to pump water into the mains at 50 lb. pressure at a fuel cost of ¼c per 1000 gallons, and will also be able to deliver water for fire-fighting at a pressure of 100 lbs. per square inch.

SAN DIEGO, CAL.—W. G. Henshaw of San Francisco, representing a New York syndicate, has proposed to the city council to develop and supply the city of San Diego, by March 1, 1915, a minimum of 5,000,000 and a maximum of 20,000,000 gallons of San Luis Rey River water at 12c per 1000 gallons, daily. Mayor O'Neill and members of the council express their approval of the project. The project involves $10,000,000 and includes the purchase of Warner's ranch, which will give the syndicate control of 98 per cent of the riparian rights of the San Luis Rey River.

SAN FRANCISCO, CAL.—Spring Valley officials state that the company stands ready to meet the city half way in any suggestions that will result in bringing an adequate supply of water into the city, but that some decisive action must be taken or there will be an absolute want of water in this city by 1915. The city is using 49,000,000 gallons of water daily. This is all the water that can be supplied by the company until the system is enlarged. For two years the winter rains have not met the needs of the city, with the result that the company has been drawing heavily upon the reserve and the reservoirs have been depleted to a point that, with another dry winter, would result in a famine. To meet the situation an additional pipe line, it is contended, should be constructed across San Francisco Bay and a dam built in the Calaveras Valley in Alameda county. This would result in almost doubling the capacity of the Spring Valley system. The pipe line across the bay, it is estimated, will cost between $2,000,000 and $3,000,000. The Calaveras dam will cost between $1,000,000 and $2,000,000. Construction work already has been begun by the water company on the dam. A steam shovel is at work clearing away the gravel in the bed of the stream and a viaduct is being constructed to carry off the winter flow. It is estimated that the dam can be built high enough by the winter of 1914-15 to catch that year's flood and that this could be made available in time for the fair, if the pipe line is built.

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